

**Amendments to the Specification:**

Page 1, for the paragraph entitled "Cross Reference to Related Applications", please substitute the following paragraph:

--Applicants claim priority under 35 U.S.C. §119 of German Application Nos. 103 08 249.2 and 10 2004 009 068.8 filed February 25, 2003 and February 23, 2004, respectively.--

Page 2, for the first full paragraph, please substitute the following paragraph:

--Furthermore, only a few years ago, the use of phase-stabilized laser systems for producing femtosecond light pulses as highly precise frequency ~~normal lines~~ references became known. This development makes it possible, for example, to measure optical transitions with great accuracy. By means of a direct link between the optical spectrum range and the most precise clocks, at this time, in the range of microwave and radio frequencies, such systems replace complicated and expensive frequency ~~conductor~~ division chains. In the field of optical frequency metrology, as well, there are interesting areas of application for laser systems that produce femtosecond light pulses.--

Pages 7-8, for the paragraph bridging pages 7 and 8, please substitute the following paragraph:

--Optionally, the light pulses amplified using the device according to the invention can be coupled out of the amplifier fiber and passed to an optical compressor for further temporal compression, as a free beam. Such a compressor, such as a prism compressor, for example, allows a precise adjustment of the temporal frequency behavior or "chirp" of the light pulses. In addition, the compressor can be utilized in order to achieve minimal pulse durations. Experiments have shown that it is possible, using the device according to the invention, to generate light pulses that do not have the undesirable, temporally widely expanded pulse wings, whereby if the amplifier fiber is additionally followed by a prism compressor, the achievable pulse duration lies in the range of only 65 femtoseconds. At the same time, the achievable pulse energy is 1.5 nanojoules and more.--

Page 10, for the first full paragraph, please substitute the following paragraph:

--To implement an optical synthesizer for optical frequency metrology, it is necessary to generate optical frequency combs that span more than one optical octave and have a sufficiently high pulse repetition rate. These optical frequency combs are necessary because only a full optical octave allows simple determination of the aforementioned offset frequency, and thereby a complete characterization of the optical frequency comb. If the optical frequency comb spans more than one optical octave, the long-wave mode of the frequency comb can be frequency-doubled and brought into interference with a corresponding short-wave mode. The offset frequency value being searched for can be determined directly on the basis of the ~~interference~~ beat frequency.--

Page 13, for the second full paragraph, please substitute the following paragraph:

--Turning now in detail to the drawings, the device shown in FIG. 1 has a pulsed laser light source 1. Light source 1 produces fiber-coupled femtosecond light pulses having a low power. In experiments, a laser ~~diode~~ source that emits light pulses having a pulse energy of 45 picojoules at a repetition rate of 67 MHz has proven itself. A purely fiber-based laser

light source that can be used in the device according to the invention is described, for example, in the article by Tamura et al. in Optics Letters, Volume 18, page 1080, 1993.--

Pages 13-15, for the paragraph spanning pages 13-15, please substitute the following paragraph:

--The light pulses emitted by laser light source 1 are coupled into a commercially available telecommunications fiber 2. Fiber 2 has a negative group velocity dispersion (e.g. - 0.023 ps<sup>2</sup>/m). In the embodiment shown in FIG. 1, fiber 2 functions as an optical stretcher, in which the light pulses of pulsed laser light source 1 are temporally stretched. The stretched light pulses then pass through an optically pumped amplifier fiber 3, which is an optical fiber highly doped with erbium ions (500 to 1000 ppm). According to the invention, amplifier fiber 3 has a positive group velocity dispersion (e.g.+0.057 ps<sup>2</sup>/m), so that the occurrence of solitonic optical effects in amplifier fiber 3 is prevented. The doping of amplifier fiber 3 is such that ~~a weakening~~ attenuation of the light (wavelength 1.5  $\mu$ m) that passes through the fiber, by 80 decibels per meter, occurs without optical pumping. Amplifier fiber 3 is pumped by two laser diodes 4, in the device shown in

Fig. 1, which work at a wavelength of 980 nm or 1480 nm. In experiments, laser diodes having an output power of 200 mW each were used. The light of the laser diodes is coupled into amplifier fiber 3 by way of so-called wavelength-division multiplexing or WDM couplers 5. Amplifier fiber 3 has non-linear optical properties, which has the result that during the amplification process, the optical spectrum of the light pulses temporally stretched by means of fiber 2 is broadened, taking advantage of non-linear self-phase modulation. Because of the positive group velocity dispersion of amplifier fiber 3, the light pulses that were previously stretched using fiber 2 are also temporally compressed. At the output of amplifier fiber 3, light pulses are therefore available that have a pulse duration of  $\leq 100$  femtoseconds. In order to prevent the occurrence of excessive non-linearity, the light pulses are coupled out of amplifier fiber 3 by means of a lens 6 after the amplification process. Two wave plates 7 and 8 are provided in order to adjust a horizontal polarization state of the light pulses. Alternatively, a fiber-optic polarization plate could also be used. Subsequently, the light pulses are compressed to a minimal pulse duration in a silicon prism compressor 9, through which they pass in two ways. To prevent reflection losses within prism compressor 9, the prisms are arranged at the Brewster angle. In

experiments, it was possible to achieve light pulses having a pulse duration of 65 femtoseconds and a pulse energy of 1.5 nanojoules at the output of the device shown. At a repetition frequency of 67 MHz, these pulses correspond to an average output power of 110 mW. Instead of the prism compressor, the use of a lattice compressor, a so-called "chirped" mirror, or a so-called fiber Bragg ~~lattice~~ grating would also be easily possible.--

Pages 15-17, for the paragraph spanning pages 15-17, please substitute the following paragraph:

--FIG. 2 shows an optional expansion of the device according to the invention. In this embodiment is provided an additional, highly non-linear optical fiber 10, into which the amplified light pulses are coupled, in order to generate an optical frequency comb that covers more than one optical octave. A lens 11 is provided in order to couple the pulses into additional fiber 10. By means of another lens 12, the light pulses modified by means of fiber 10 are coupled out. However, it would be equally possible, depending on the case of use, to pass the light pulses directly from amplifier fiber 3 to the highly non-linear fiber 10, e.g. by means of a suitable splice connection. The highly non-linear optical fiber can be a glass fiber having a

very small core diameter of  $\leq 5 \mu\text{m}$ . In experiments, a glass fiber having a core diameter of  $3.7 \mu\text{m}$  was successfully used, in order to generate an optical frequency comb that included more than one optical octave. At wavelengths of less than  $1.3 \mu\text{m}$ , the use of microstructured photonic crystal fibers of known type, as the highly non-linear fiber, is advantageous. In fiber 10, extreme, non-linear optical effects occur, which result in severe modifications of the optical spectrum of the light pulses. After less than 10 cm of ~~running~~ traveling distance in fiber 10, the optical spectrum extends from approximately 950 nm to approximately  $2 \mu\text{m}$ . With this range, the continuum produced has a band width of more than one octave. In experiments, a highly non-linear fiber 10 having a length of 7 cm was used. At a greater fiber length, the effectiveness of the non-linear processes decreases towards the output of fiber 10, and no further broadening of the spectrum occurs. If the fiber piece 10 is selected to be shorter, the spectrum of the generated optical frequency comb is narrower. By way of changing the length of the fiber piece 10, the spectrum of the exiting light pulses can therefore be continuously detuned, within certain limits. An interferometer 13 shown in FIG. 2 serves to characterize the optical frequency comb and, in particular, the offset frequency value, which determines the absolute position of the frequency

comb in the frequency space. Long-wave modes of the frequency comb are first frequency-doubled in an optically non-linear crystal 14 (e.g.  $\beta$ -barium borate), so that a spectral overlap with the short-wave range of the optical spectrum is produced. The frequency-doubled light is spatially separated by means of a polarizing beam splitter 15. In order to balance out running time differences within highly non-linear fiber 10, mirrors 16 are provided in one arm of the interferometer shown, which form a variable optical delay segment. By way of additional mirrors 17 and a second polarizing beam splitter 18, the light beams are brought into superimposition on a silicon avalanche photodiode 21, after having passed through an interference filter 19 and a polarizer 20. An interference signal is detected by means of the photodiode 21. The repetition rate of the laser light source as well as the offset frequency value that is of interest can be read directly from the radio frequency spectrum of the interference signal.--